LIMITING REAGENTS

#3 $Fe + 2HCl \longrightarrow H_2 + FeCl_2$

m	7.56g			
mm	55.85			
η	0.135	0.1		

L.R. ?

$\frac{1\,Fe}{2\,HCl} = \frac{0.135}{x}$

$x\ HCl = 0.270$

HCl is L.R as there is not enough

Amount of Fe in excess:

→ for every 0.1 mol HCl, 0.05 moles of Fe are required.

THUS 0.085 moles of Fe are in excess.

TO DETERMINE MASS OF PRODUCTS

$Fe + 2HCl \longrightarrow H_2 + FeCl_2$

m			0.101g	6.34g
mm			2.02 g/mol	126.75 g/mol
η		0.1	0.05	0.05

$\therefore m_{H_2} = 0.101g$

$m_{FeCl_2} = 6.34g$

#4 $Fe + S \longrightarrow FeS$

m	7.62g	8.67g
mm	55.85g/mol	32.06g/mol
n	0.136	0.270

I HAVE ENOUGH SULFUR.

∴ IRON IS THE L.R.

L.R?

$$\frac{1\ Fe}{1\ S} = \frac{0.136}{x} \quad \therefore x = 0.136\ mol\ S$$

TO DETERMINE MASS OF FeS:

$Fe + S \longrightarrow FeS$

m			
mm		87.91 g/mol	$m = n \times mm$
n	0.136	0.136	$= 11.96\ g$

#5 $4\ C_3H_6 + 6\ NO \longrightarrow 4\ C_3H_3N + 6\ H_2O + N_2$

m	21.6g	21.6g	?
mm	42.09 g/mol	30.01 g/mol	
n	0.513	0.720	

LR?

$$\frac{4\ C_3H_6}{6\ NO} = \frac{0.513}{x}$$

$4x = 6(0.513)$

$x = 0.770$ mol NO

DO NOT HAVE ENOUGH.

THUS NO IS L.R.

TO FIND OUT MASS OF C_3H_3N PRODUCED:

$\ldots 6NO \rightarrow 4\ C_3H_3N \ldots.$

m		?
mm		53.07 g/mol
n	0.720	0.48 mol

$m_{C_3H_3N} = n \times mm$

$= 0.48 \times 53.07$

$= 25.47\ g$

$$\frac{6NO}{4\ C_3H_3N} = \frac{0.720}{x}$$

$6x = 4(0.720)$

$x = 0.48$ mol.

#6

$$P_4 + 6\,Cl_2 \longrightarrow 4\,PCl_3$$

	P_4	Cl_2	PCl_3
m	75g	XS	?
mm	123.88 g/mol		137.32 g/mol
η	0.605		2.42

THEORETICAL MASS = $\eta \times mm$

$= 2.42 \times 137.32$

$= 332.3\ g$

$$\%\ \text{YIELD} = \frac{\text{ACT.}}{\text{THEOR.}} \times 100\%$$

$$= \frac{111}{332.3} \times 100\%$$

$= 33.4\%$

#7 $3\,Fe(OH)_2 + 2H_3PO_4 \longrightarrow Fe_3(PO_4)_2 + 6H_2O$

	$3\,Fe(OH)_2$	$2H_3PO_4$
m	3.20 g	2.50 g
mm	89.87 g/mol ✓	98 g/mol
n	0.0356 ✓	0.0255 ✓

L.R?

$$\frac{3\,Fe(OH)_2}{2\,H_3PO_4} = \frac{0.0255}{x}$$

I HAVE ENOUGH.

∴ $Fe(OH)_2$ IS L.R.

$x = 2(0.0255)/3$

$= 0.0170$ mol H_3PO_4 ✓

TO DETERMINE THEO. YIELD OF $Fe_3(PO_4)_2$

$3\,Fe(OH)_2 \ldots \rightarrow Fe_3(PO_4)_2$

m		
mm		357.49 g/mol
n	0.0356	⟶ 0.0119

$m = n \times mm$

$= 0.0119 \times 357.49$

$= 4.25$ g

% yield $= \frac{\text{Act}}{\text{Theo}} \times 100\%$

$= \frac{3.9}{4.25} \times 100\%$

$= 0.918 \times 100\% = 91.8\%$

#8 $2NH_3 + 3CuO \longrightarrow N_2 + 3Cu + 3H_2O$

m	18.1 g	90.4 g	?
mm	17.04 g/mol	79.55 g/mol	
η	1.062	1.136	

L.R ?

$\frac{2\ NH_3}{3\ CuO} = \frac{1.062}{x}$

do not have enough. ∴ CuO is L.R.

$x = 1.593$ mol CuO

TO DETERMINE THEOR. YIELD OF N_2:

$\ldots 3CuO \longrightarrow N_2 \ldots$

m		
mm		28.02 g/mol
η	1.136	$\longrightarrow$ 0.379

$m = \eta \times mm$

$= 10.6$ g of N_2

#9 $6Li + N_2 \longrightarrow 2Li_3N$

	$6Li$	N_2
m	56g	56g
mm	6.94 g/mol	28.02 g/mol
n	8.07	2.00

L.R.?

$\frac{6Li}{1N_2} = \frac{8.07}{x}$

$6x = 8.07$

$x = 1.345$ moles of N_2

I HAVE ENOUGH N_2.

$\therefore$ Li IS THE L.R.

... $6Li \longrightarrow 2Li_3N$

m		
mm		34.83 g/mol
n	8.07	2.69

$m = n \times mm$

$= 93.7\,g$

$\%\ yield = \frac{ACT}{THEOR} \times 100\%$

$= \frac{76.8}{93.7} \times 100\%$

$= 82\%$